Making People Stupid

Gary Klein, Ph.D.

Klein Associates

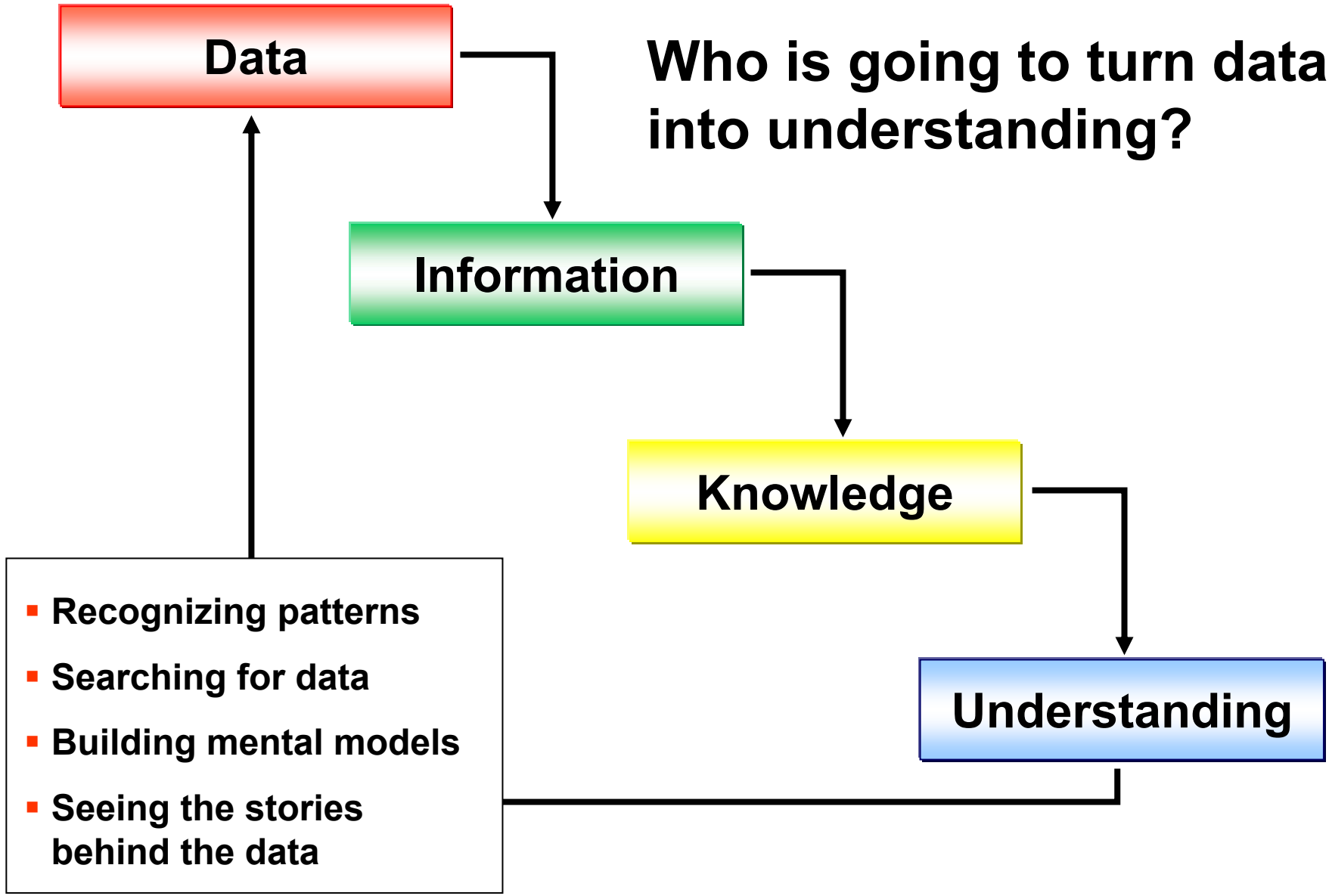
A Division of Applied Research Associates, Inc.

Presentation at the UHSI Conference

Mystic, CT

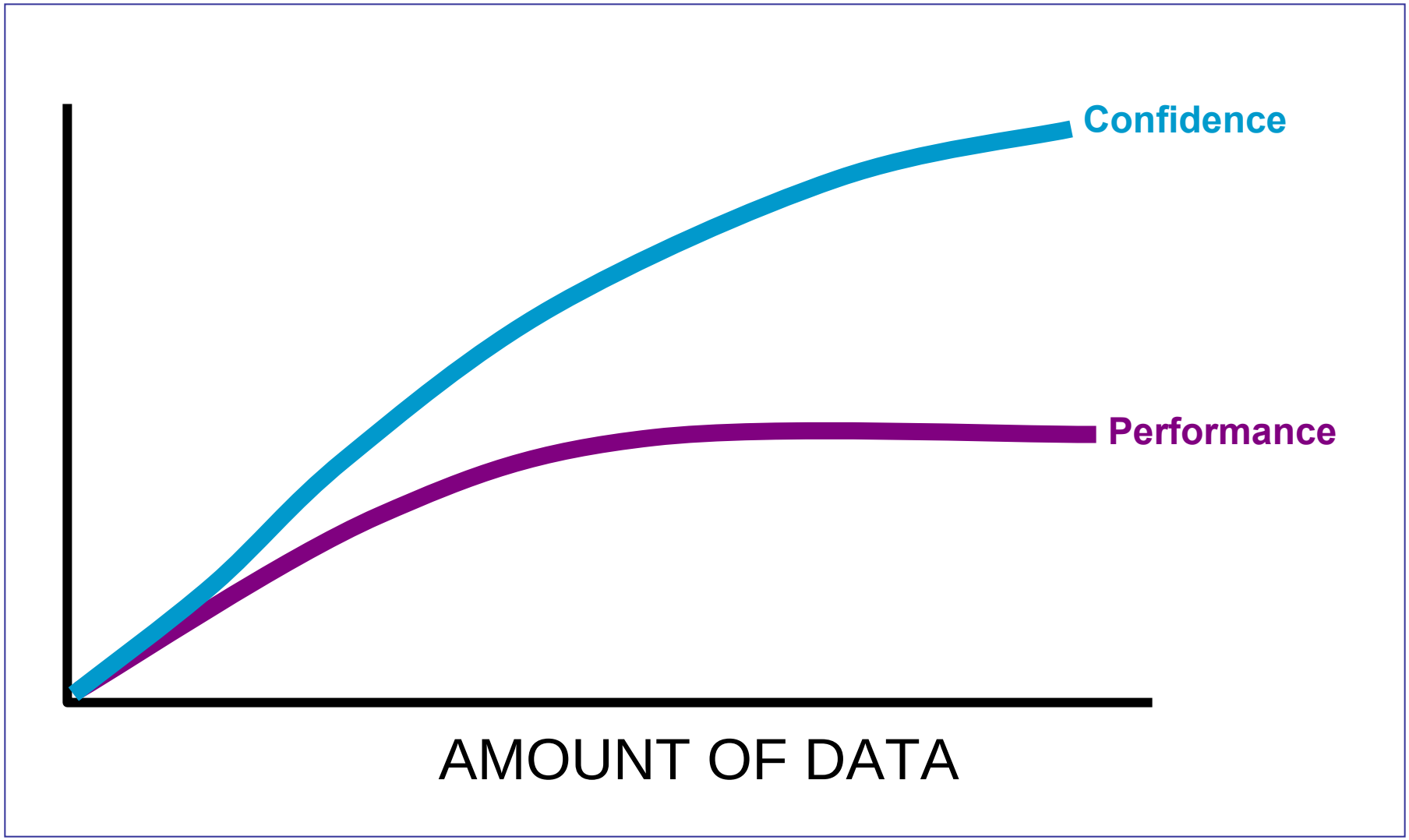
7 June 2006

klein ASSOCIATES
A Division of Applied Research Associates, Inc.

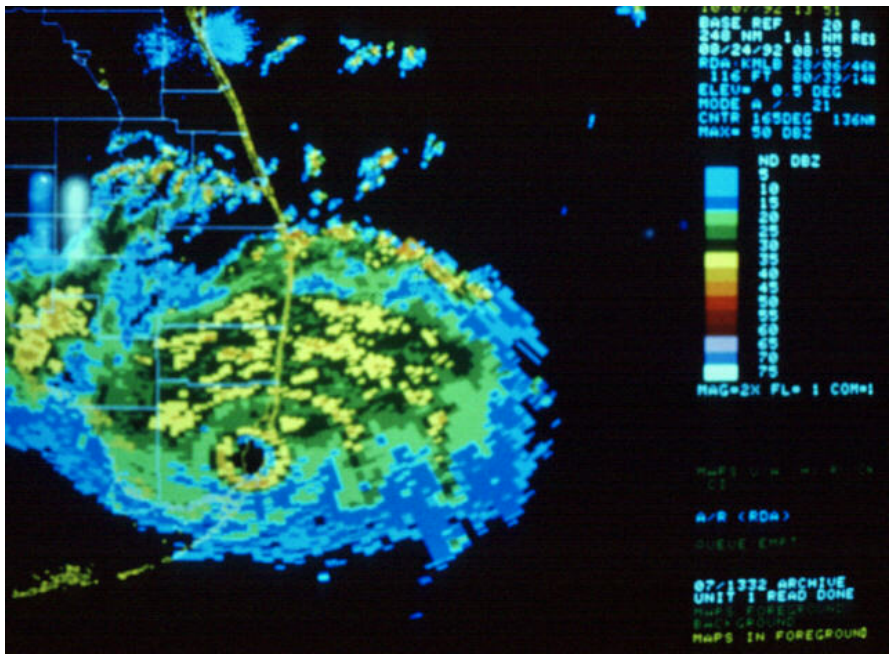

Data
Information
Knowledge
Understanding
Who is going to turn data into understanding?
Recognizing patterns
Searching for data
Building mental models
Seeing the stories behind the data

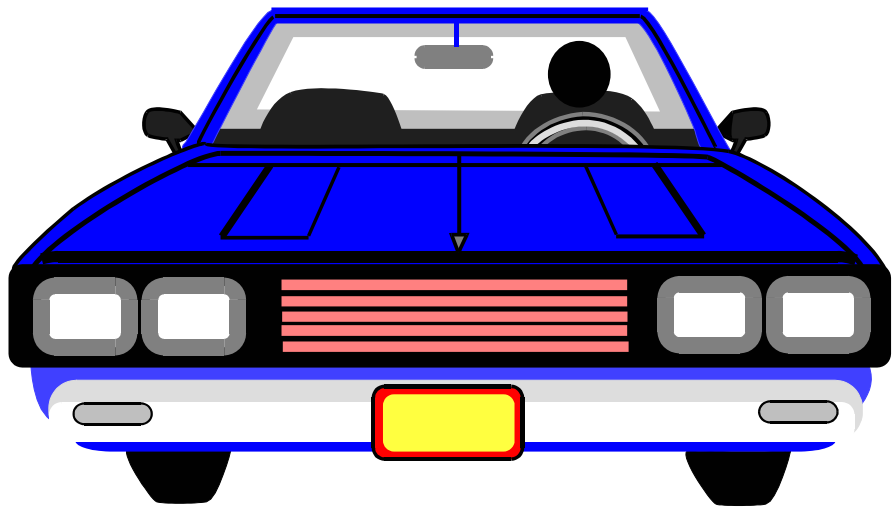
How To Make People Stupid

Provide Too Much Data



Disconnect them from the data





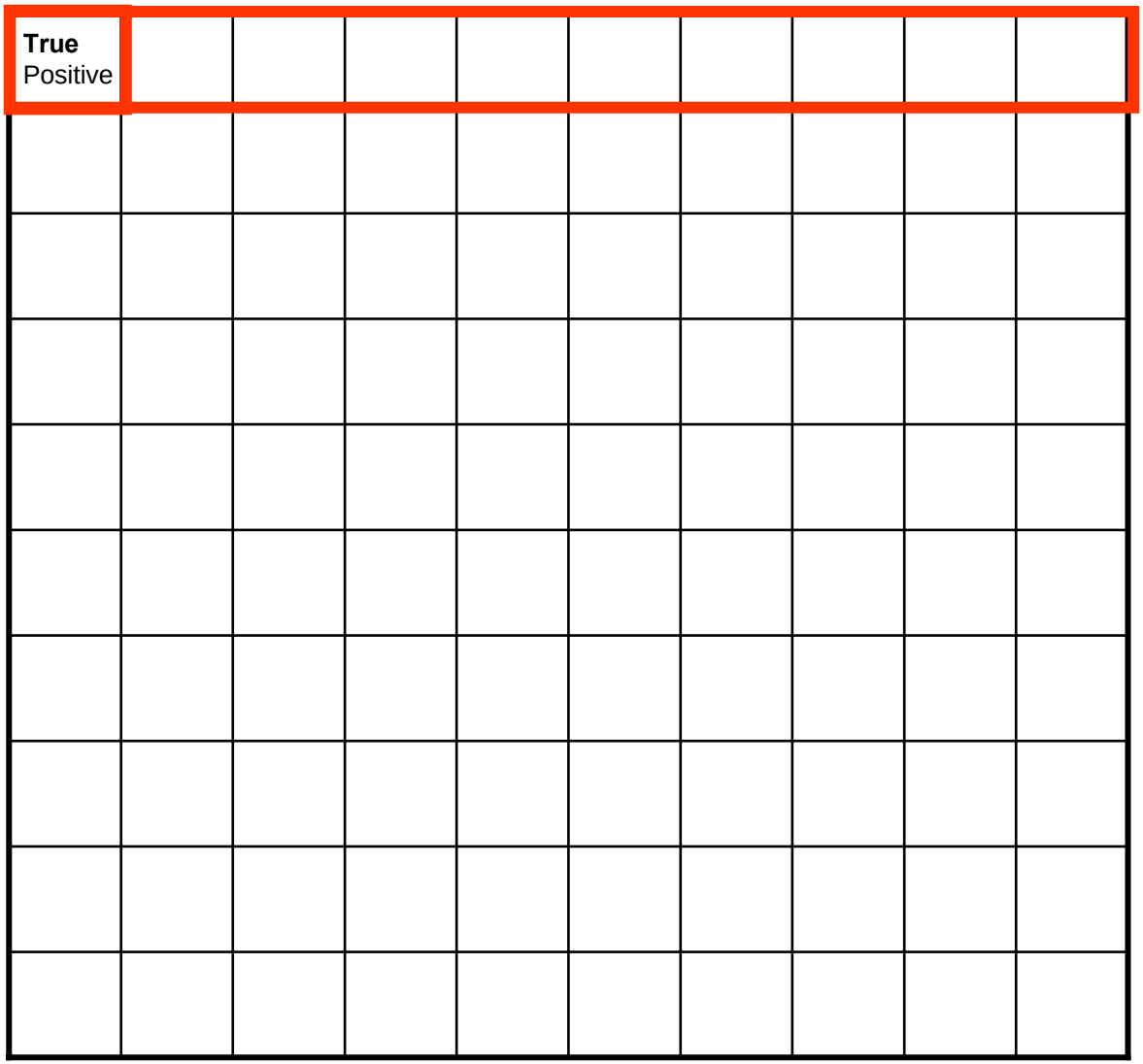
Find ways to obscure the data

- Use a language they don’t speak fluently
- Only show part of the story
- Make it hard to see connections between data

What are the chances that a woman who tests positive actually has breast cancer?

- The probability that a woman over the age of 40 has breast cancer is about 1%.
- If she has breast cancer, the probability that she tests positive on a screening mammogram is 90%.
- If she does not have breast cancer, the probability that she nevertheless tests positive is 9%.

Using frequencies to see the picture



Test Positive
n = 10

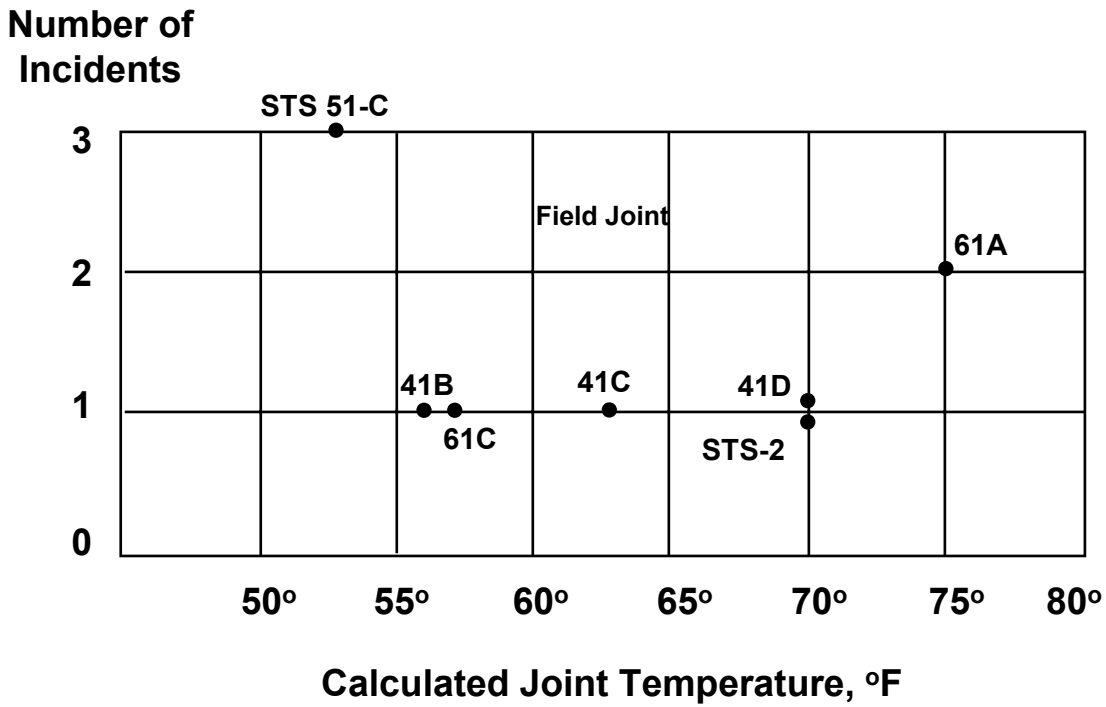
Test Negative
n = 90

Total
n = 100

Gigerenzer and Hoffrage (1995)

The Decision to Launch the Space Shuttle Challenger

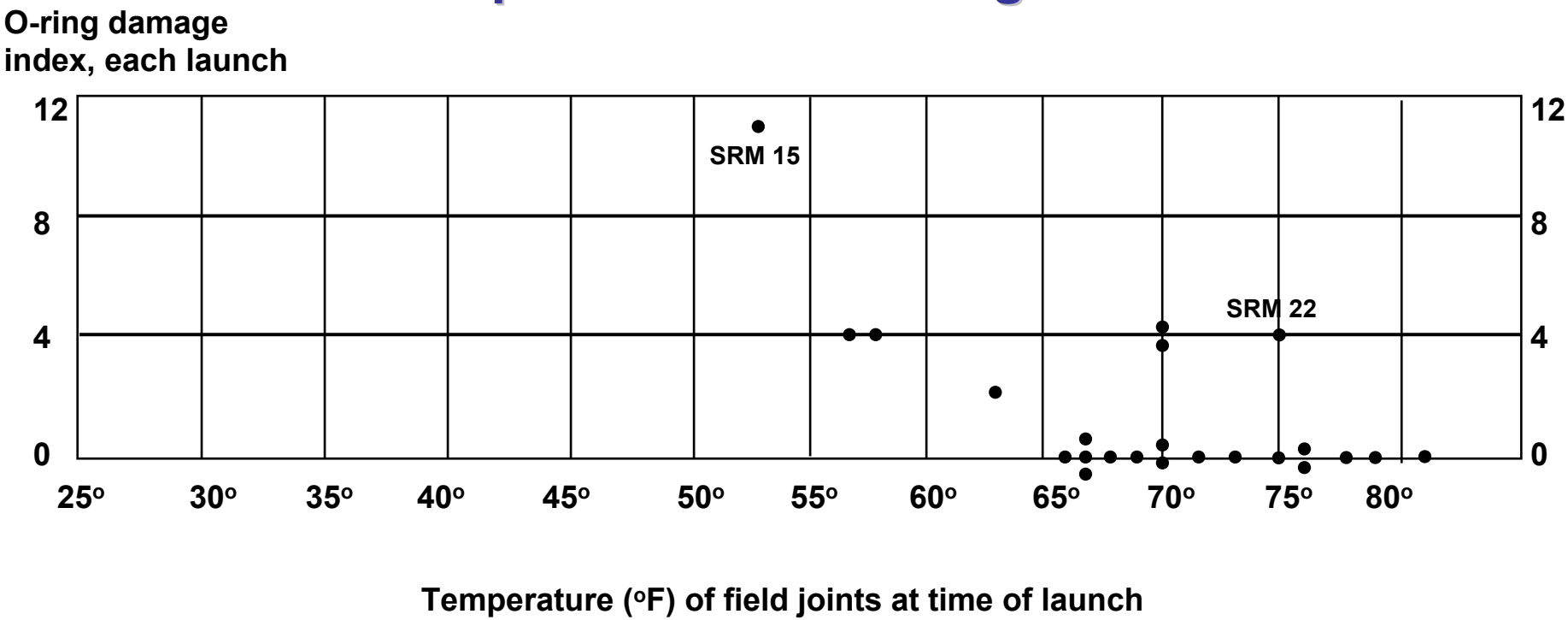
Scatterplot graph depicting launches with O-ring damage and their temperatures, omitting all damage-free launches



Tufte, E. R. (1997). *Visual explanations*. Cheshire, CT: Graphics Press, p. 46.

The Decision to Launch the Space Shuttle Challenger

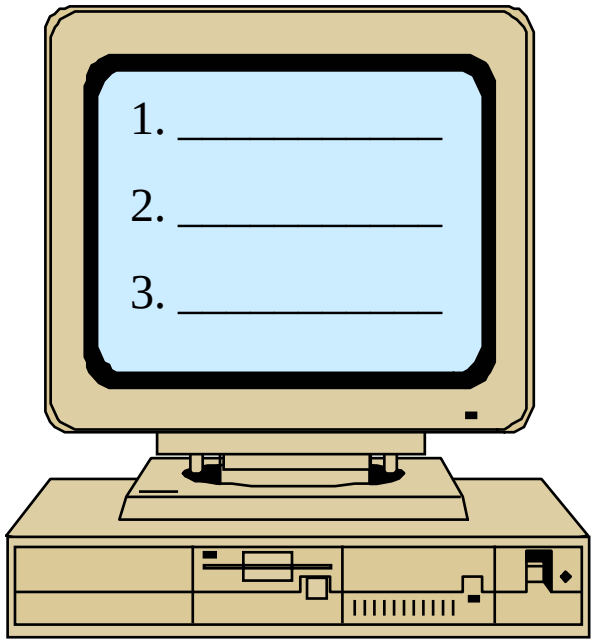
Scatterplot graph showing the experience of all launches prior to the Challenger



Tufte, E. R. (1997). *Visual explanations*. Cheshire, CT: Graphics Press, p. 45.

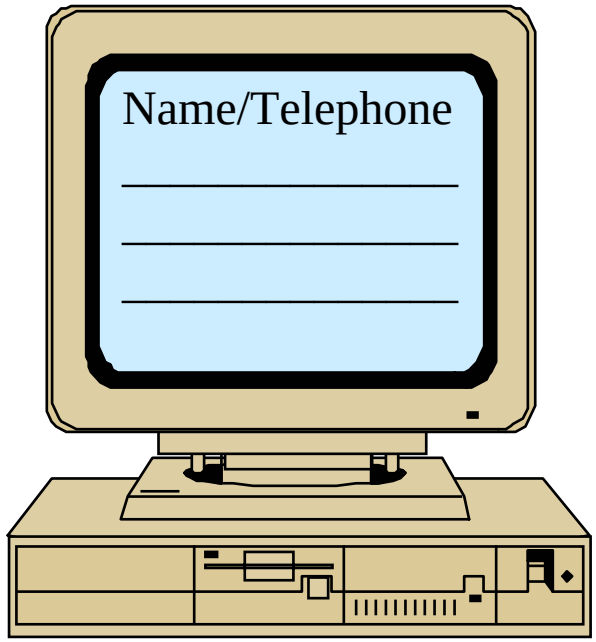
Watchstander

Categories of Responders



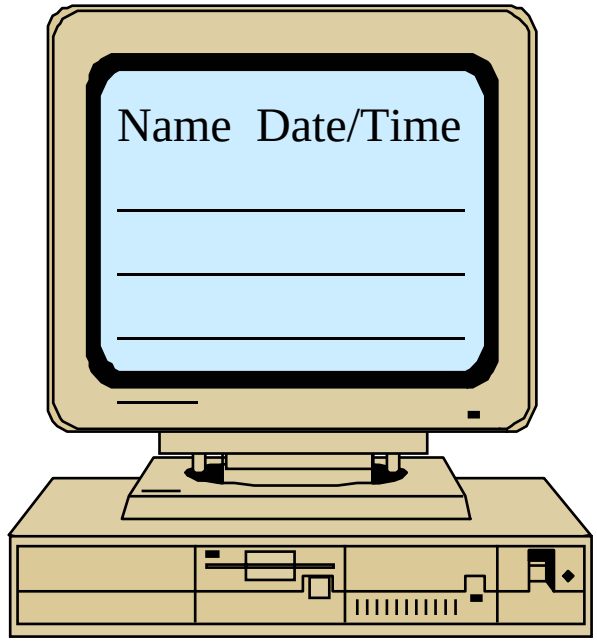
Screen 1

Members of Each Category



Screen 2

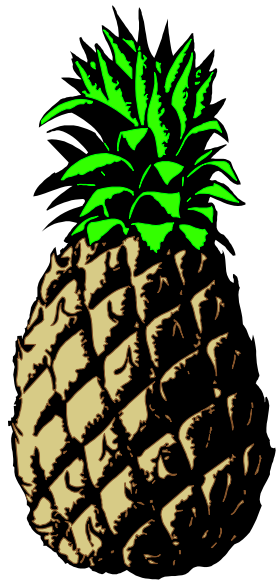
Verification Calls Received



Screen 3

Limit the search for data

- Present too much data
- Obscure the data
- Disconnect them from the data
- Limiting the search for data



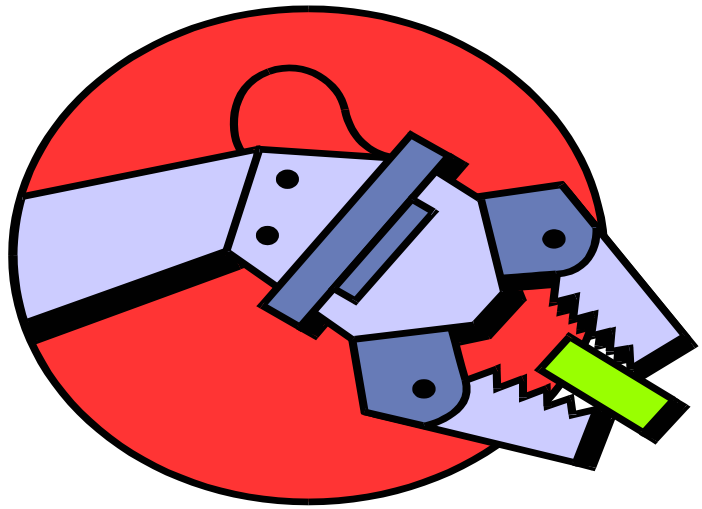
Weaken their mental models

- Present too much data
- Obscure the data
- Disconnect them from the data
- Limit the search for data
- Weaken their mental models

“Fusion Algorithms”

Make them less adaptive

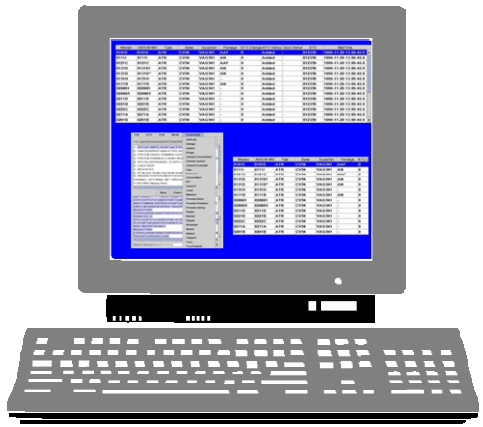
- Present too much data
- Obscure the data
- Disconnect them from the data
- Limit the search for data
- Weaken their mental models
- Make them less adaptive



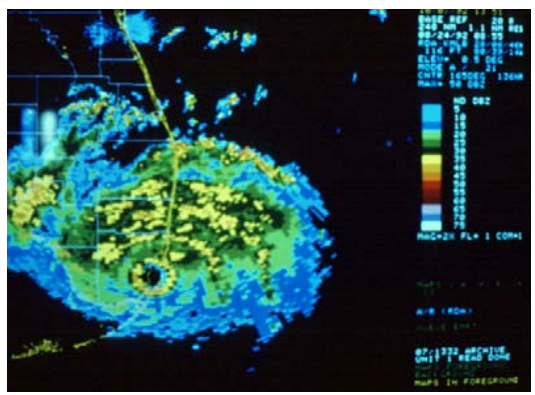
"Adaptive Systems"

Make them passive

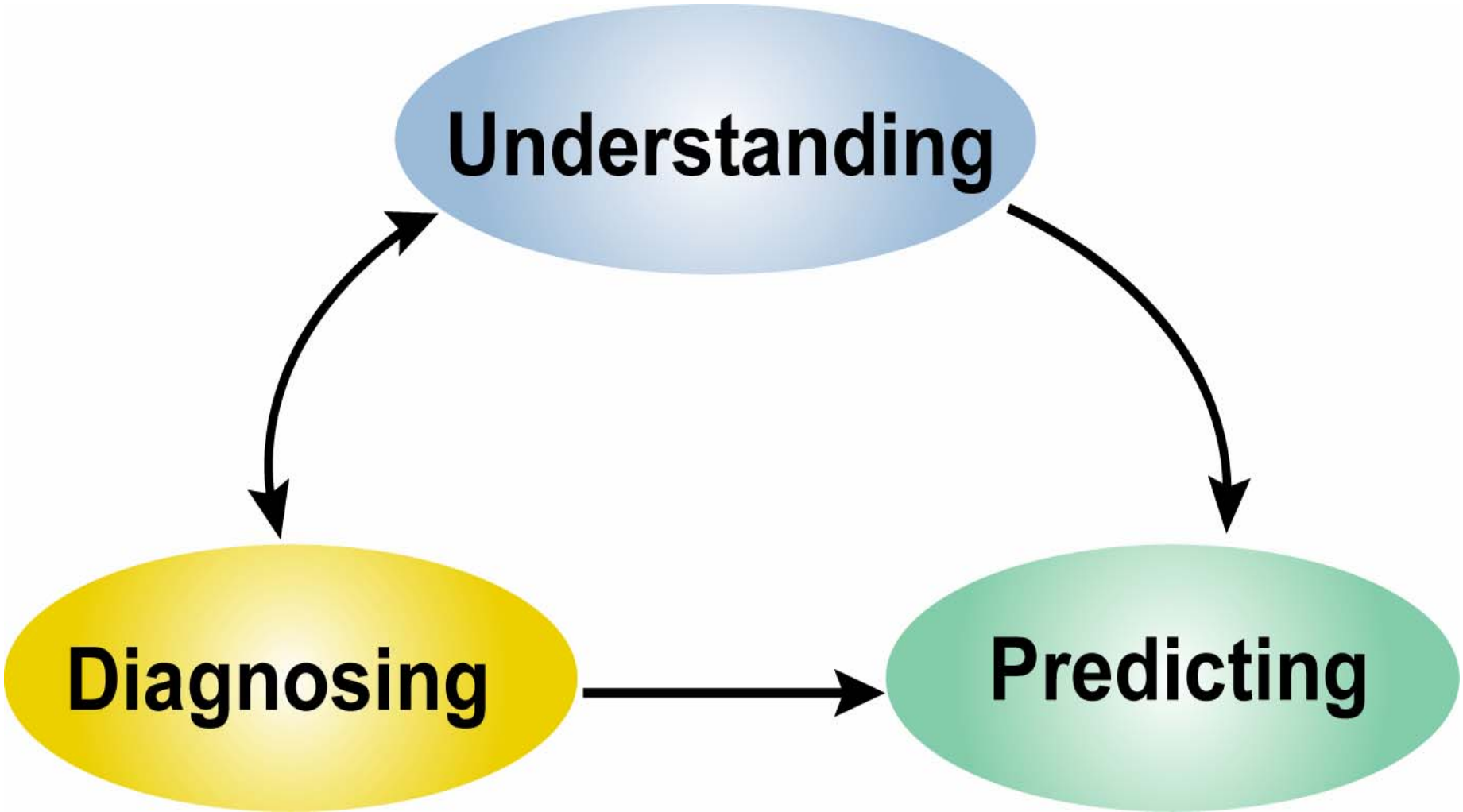
- Present too much data
- Obscure the data
- Disconnect them from the data
- Limit the search for data
- Weaken their mental models
- Make them less adaptive
- Make them passive



Air Tasking Orders (ATOs)



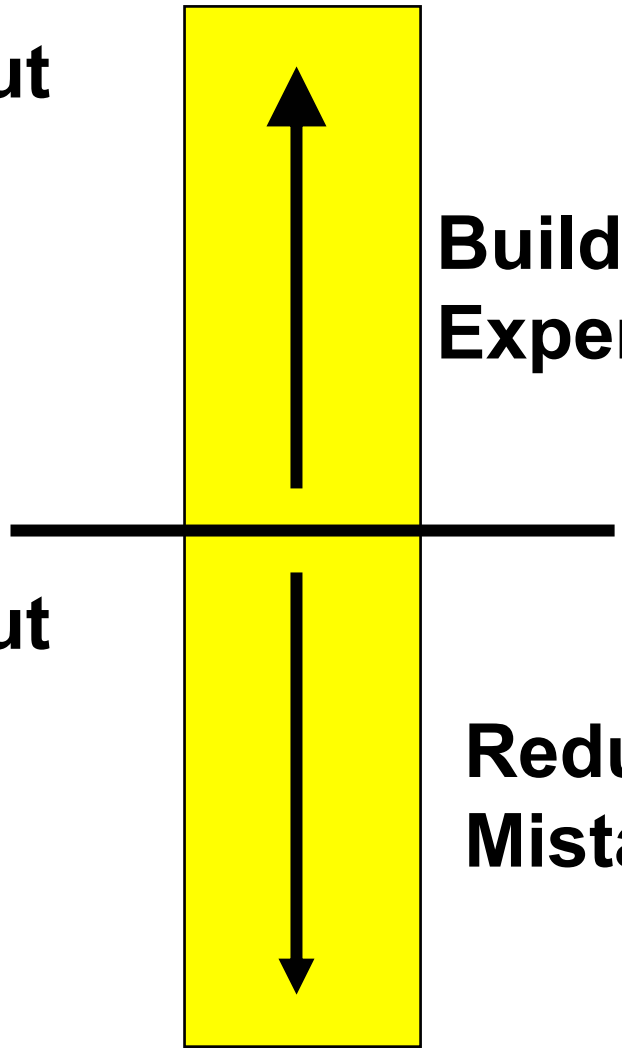
Forecasting Process



Avoiding Mistakes ≠ Gaining Insights

What resources do we put in place to help people build expertise?

What resources do we put in place to help people avoid mistakes?



Making People Smart

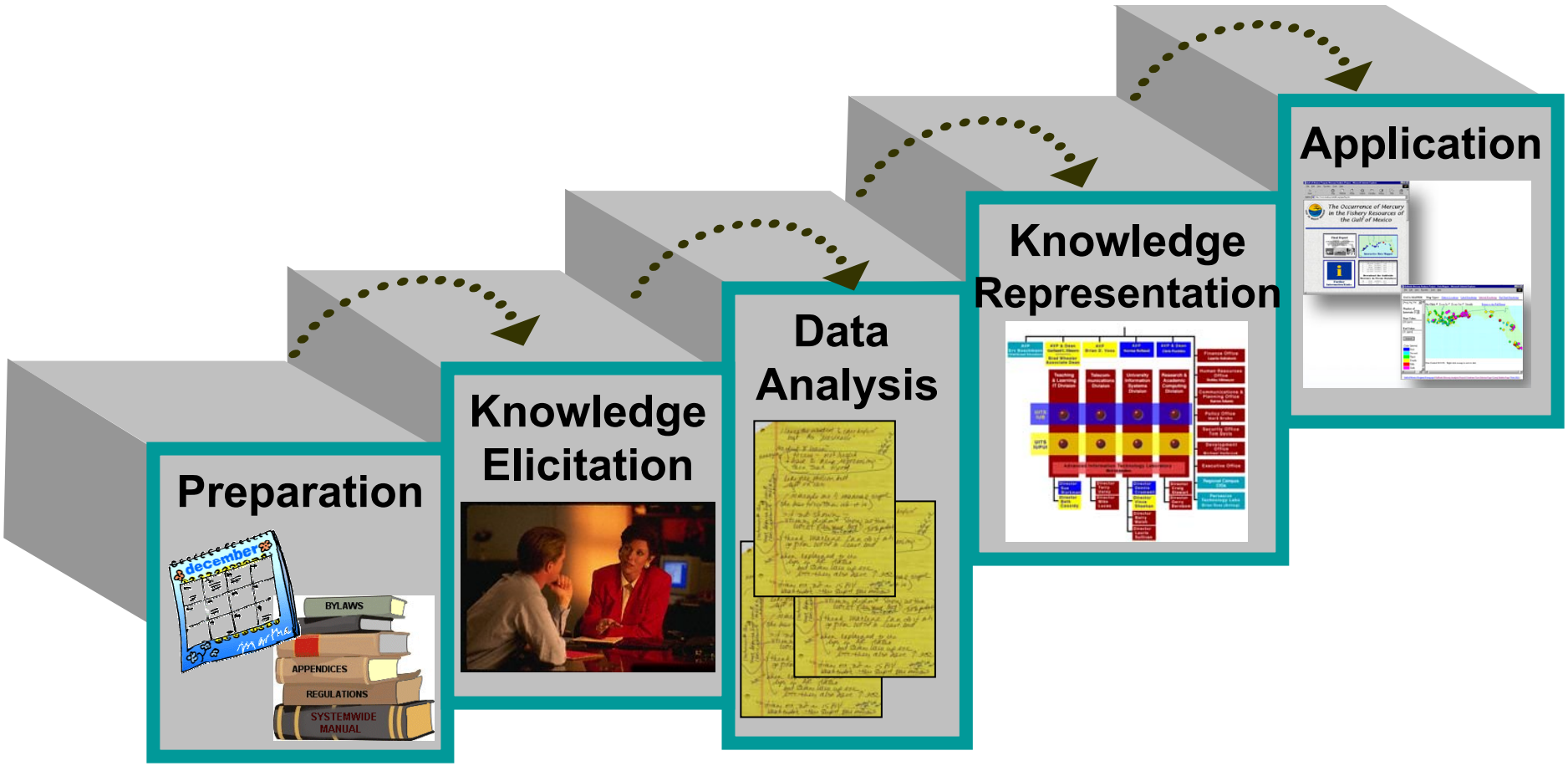
- Capture and apply the knowledge of people with experience
- Understand the cognitive challenges of a task
- Support the growth of tacit knowledge

Cognitive Task Analysis

CTA is the description of the skills and strategies needed to perform a task proficiently

Even experts have difficulty describing what they can see and do

Phases of CTA

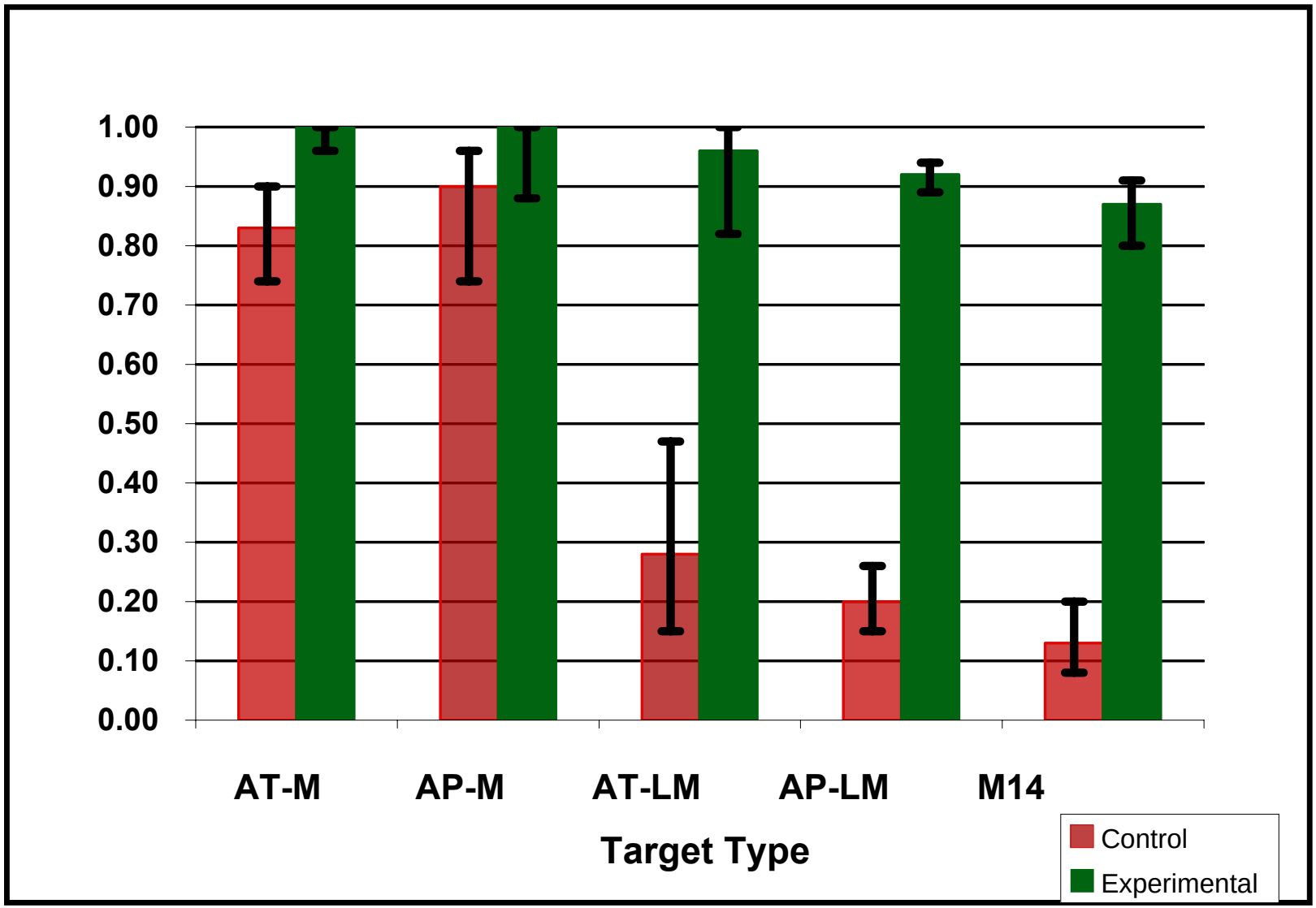


Expertise in Mine Detection

- Army has spent $38M over 9 years to develop better landmine equipment.
- State of the art: Handheld Standoff Mine Detection System (HSTAMIDS).
- With HSTAMIDS, success rate for modern mines was only 10-20% accuracy on a controlled course.
- CTA of landmine experts (n=4) to learn their tricks of the trade. Output = 12-15 hour training program.
- Result=90-97% detection rate for the most difficult mines (small, anti-personnel with low metallic content), using HSTAMIDS.
- Study with 180 combat engineers preparing to deploy. Training time reduced to one hour. Pre-training accuracy = 20% detections. Post-training accuracy reached 80% detection rates.
- Researcher: Jim Staszewski, Carnegie Mellon University.

Performance of Experimental & Control Groups

Initial PSS-12 Training Test at Ft. Leonard Wood, October '99



Five Types of Knowledge

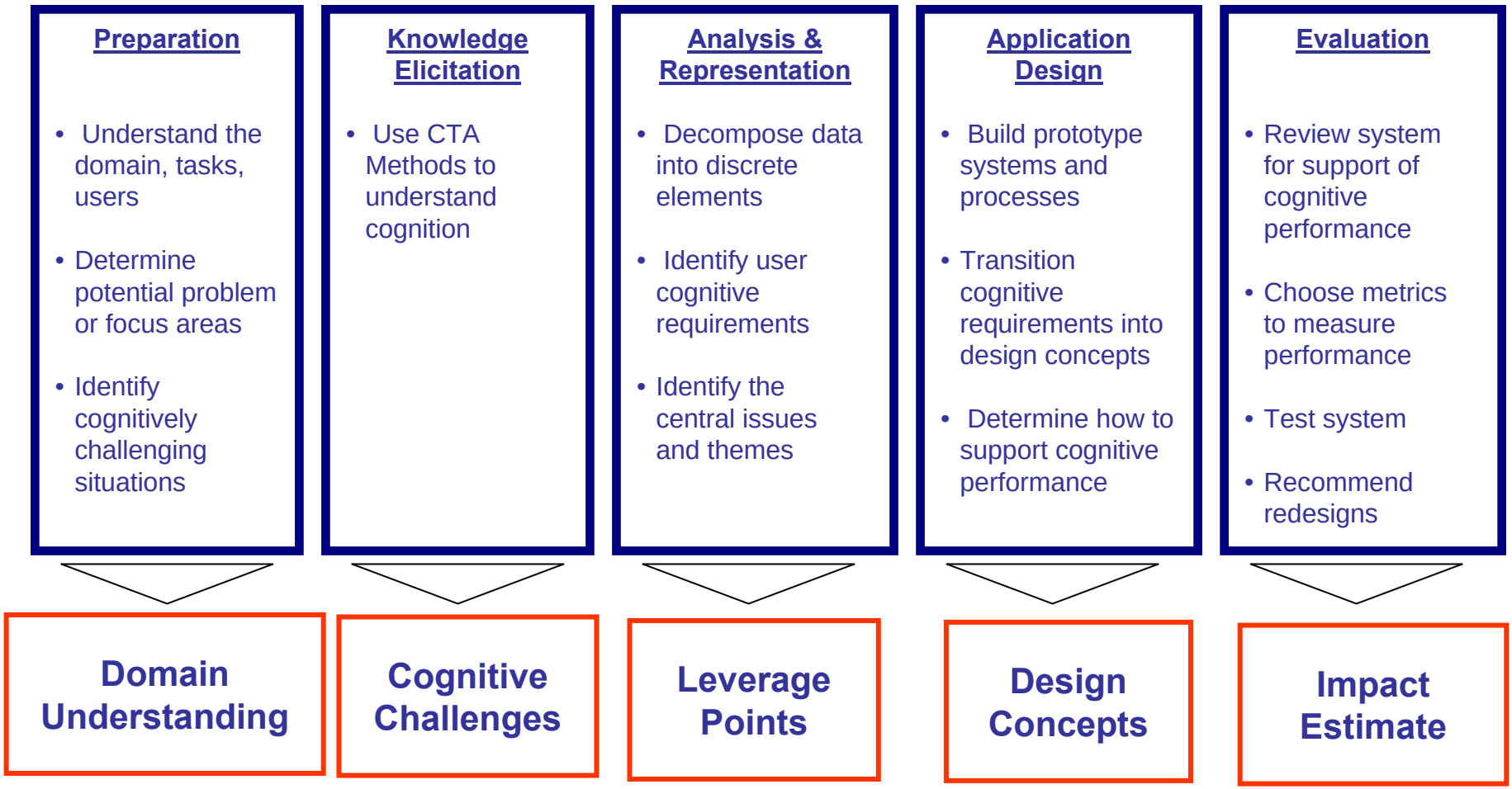
1. Declarative information
2. Routines and procedures
3. Repertoire of patterns
   - Provide a sense of typicality
   - Provide a basis for detecting anomalies
4. Perceptual discriminations
5. Mental models
   - Beliefs about the causes that make things happen

Cognitive Systems Engineering

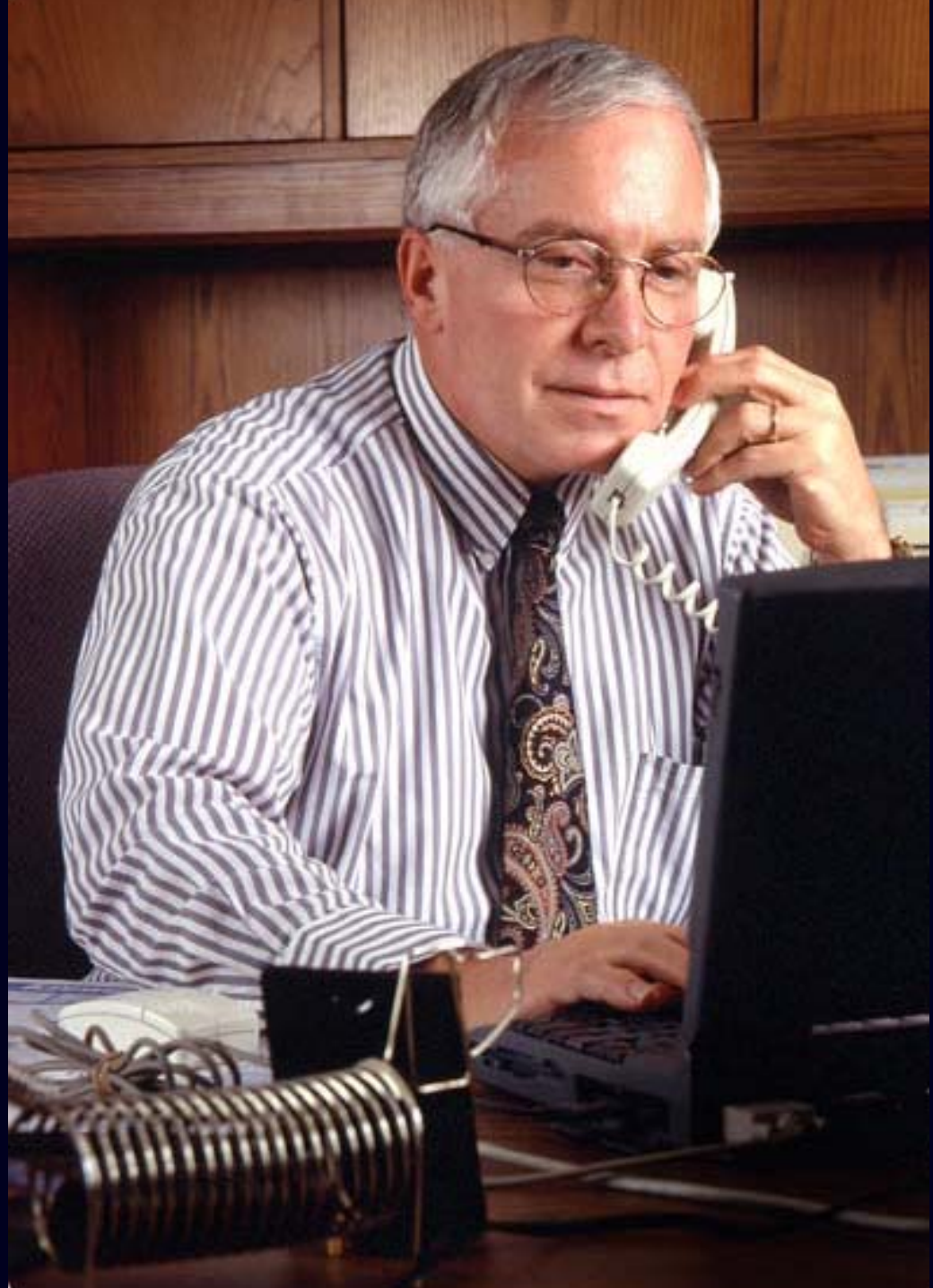
- **Goal: Support cognitive functions**
- **Cognitive engineering is needed to tailor the fit between Information Technology and decision makers**
- **Cognitive engineering is needed—at three points:**
  1. **At the beginning—design requirements that will support the user**
  2. **During the development—to modify, refine and improve the systems**
  3. **At the end—Test and Evaluation criteria**

Cognitive Systems Engineering

Five Phases of Design



Crandall, B., Klein, G., & Hoffman, R. R. (in press). *Working minds: A practitioner's guide to Cognitive Task Analysis*. Cambridge, MA: The MIT Press.



Gary Klein, Ph.D.

Klein Associates

A Division of Applied Research Associates, Inc.

1750 Commerce Center Blvd. N.

Fairborn, OH 45324

937.873.8166

gary@decisionmaking.com

www.decisionmaking.com